



EVOLUTION AND GROWTH OF MUSHROOM CULTIVATION IN INDIA

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ABSTRACT

Background: A mushroom is the fleshy, spore-bearing fruiting body of a fungus, typically produced above the ground on soil or on its food source, mostly in forests. Mushrooms could potentially be very important in future food supplies and in new dimensions of sustainable agriculture and forestry. The most popular mushroom species (oyster, button, milky and paddy straw) are cultivated in upper and hilly regions of the Indian states. With the world's increasing population and its decrease in per capita arable land, along with rapid urbanization and industrialization, climate change, and a demand for quality and functional foods, it will be necessary to focus on secondary agriculture and novel crops, such as mushrooms. India, primarily being an agrarian economy, is rich in terms of agro wastes that are not properly utilized by the nation's farmers. Keeping this in view, the availability of abundant agro-wastes and varied agro-climatic conditions, mushroom cultivation has a great potential as an economic activity and means of societal development. However, mushroom cultivation is yet to be adopted by mushroom growers on a large scale. The gap in technology knowledge and its adoption needs to be bridged by providing training to farmers regarding various aspects of mushroom cultivation. The objective of this paper is to discuss the process of mushroom cultivation, growth of mushroom industry, the challenges and the policy recommendations. The information used in this paper is based on the existing literature and data available, particularly from the reports available from the government organizations. The methodology used is more a review and synthesis.

KEYWORDS: Mushroom, Industrialisation, Agro-Waste, Sustainable

INTRODUCTION

Mushrooms are fleshy spore bearing structures of the fungi. Mushrooms appear after rains in various shapes, sizes and colors. The economic importance of mushroom lies primarily in their use as food for human consumption. With the depletion in per capita land holding in the state, mushroom cultivation is a lucrative option for the cultivators. The medicinal and nutritional value of mushroom emphasizes the consumption of mushrooms. Mushrooms are a source of quality proteins having essential amino acids with high digestibility.

Mushroom is an ideal food for diabetic patients due to absence of starch; it is also useful for high blood pressure and obesity because it is free from cholesterol and has very less fat. Worldwide more than 3000 mushrooms have been identified as edible, but not more than 60 varieties are being grown widely. India is home to more than 300 varieties of mushrooms found in the wild. In India, three types mainly, button, oyster and straw mushrooms are extensively cultivated on commercial scale.

Growth of horticulture over the years has established the fact that it is the most suitable vocation for overcoming inherent problems like low land-man ratio, climate change, untimely rainfall etc. Horticulture has a bright future in the country, particularly for marginal and small farmers to improve their economic condition at the present level of land resources and available technology.

In the last five years, the mushroom production in India has almost doubled from 1.00 lakh MT to 2.01 lakh MT. Mushroom cultivation utilizes vertical space and less water compared to other crops. It is a crop of waste to wealth, thereby promoting the concept of sustainable agriculture. The mushroom cultivation also strengthens the livelihood of farmers by generating constant farm income, nutritional security and employment opportunities. Mushroom cultivation is labour intensive process. Cheap labour availability is the greatest advantage for India. Mushroom is a recent and innovative crop for India. Serious efforts towards commercial mushroom cultivation took place in 1977 when UNDP Mushroom Development Project was started in Solan, under which bulk compost was supplied to the growers. In 1983 National Research Centre for Mushroom was established under the aegis of Indian Council of Agricultural Research (ICAR). After 25 years, with remarkable achievements in mushroom research, National Research Centre was upgraded as Directorate of Mushroom Research (DMR) on 26th Dec, 2008. This is the only institute dedicated to mushroom research and development in the country.

Himachal Pradesh is a hilly state of India, which has become one of the fastest growing economies of the country. The economic growth of the state is still governed by agricultural activities. There has been a shift from agriculture sector to service sector in percentage contribution towards the state domestic product, but the declining share of agriculture sector, does not affect the importance of this sector in the economy of Himachal Pradesh. The growth in primary sector is still determined by the rising trends in agriculture and horticulture production. Himachal Pradesh is the only state in the country where 89.96 percent of the people live in rural areas (Census 2011). Agriculture/ Horticulture provide direct

employment to about 70 per cent of total workers of the State. The development of horticulture in Himachal Pradesh is not only providing nutritive food in the form of fruits and vegetables but is also playing an important role in promoting environmental conservation. Horticulture has made huge progress in Himachal Pradesh since so many years.

Himachal Pradesh has its own limitations in adoption of biotechnological innovations of recent origin due to its mountainous topography. An assessment of the agro climatic conditions, land and vegetative resources, has revealed that traditional agriculture has a limited scope in the State and a shift in the cropping pattern to high pay off commercial crops is important for increasing the productivity of the land. Such a shift in cropping pattern had lead to remarkable achievement in the field of horticulture which has come to play an important role in the economy of the State.

The state is continuously making significant progress in development of horticulture sector. Horticulture includes the cultivation of (i) fruits such as apple, mango, citrus fruits etc., (ii) nuts and dry fruits, (iii) vegetables and potatoes, (iv) new emerging crop enterprises like mushroom growing, floriculture, cultivation of hops, bee keeping. The topographical variations and altitudinal differences coupled with fertile, deep and well drained soils favor the cultivation of horticultural produce like flowers, mushroom, honey and hops. The State is trying to explore and harness the vast horticulture potential of the hill State through diversified horticulture production in varied agro-ecological zones. Horticulture in Himachal Pradesh today contributes towards the achievement of major objectives of development, by increasing productivity, generating employment, utilization of available land stock, alleviating poverty and helping in maintaining the ecological balance.

PROCESS OF MUSHROOM CULTIVATION

The basic requirements for mushroom cultivation are manure/compost, spawns, right temperature and humidity. Favorable growing conditions involve 80%-90% of relative humidity, ample ventilation, a temperature range of 20-28°C during spawn run and 12-18°C for reproductive growth. If the above stated conditions are maintained appropriately the pin heads start to appear within few days and progressively mature into button stage. Apart from these insecticides, nutritional supplements like nitrogen, water are also required for a healthy harvest. The following steps are to be followed for mushroom cultivation:

Compost Preparation

The compost (synthetic or natural) used for mushroom growth usually comprises of wheat straws, horse manure, poultry manure, rice bran, gypsum etc. Utmost care is taken to protect the raw compost against rain or external moisture, as it might introduce undesirable microbes. Frequent turnings and watering is done at a specific interval so as to avoid the drying up of compost. Within 15 to 20 days the compost gets all set to be used as bed; it is then spread onto wooden trays and sowed with spawns.

Spawning

Spawning is a process of sowing or mixing spawns in compost. Although mushroom produces spores which acts as a seed for further propagation but are not used generally due to uncertain germination and growth. The spawns are thoroughly mixed with the compost, are covered with newspaper and is watered sufficiently to maintain the moisture. Throughout the cultivation period humidity is kept high to avoid loss of moisture.

Casing

Casing is a kind of sterilized soil or dressing containing cow manure which is spread onto the spawn mixed compost. After 15 to 20 days of its application mushroom head or pins start becoming visible on the surface. They are allowed to mature for a specific time period and are harvested before opening of the cap.

Harvesting

Harvesting is done by plucking them from soil using hands or the heads are chopped off using knife. The harvested mushrooms are then subjected to primary processing.

Processing

Mushroom are very fragile and have a short shelf life, unless consumed fresh. They lose their freshness within a day and deteriorates rapidly if not processed or refrigerated. They also tend to brown due to presence of compound Tyrosinase. Initial processing involves washing mushrooms to remove adhering soil or compost and blanching them for few minutes to inactivate the enzymes.

Drying

Drying or Dehydration is the oldest and the basic processing method for various food products. Mushrooms can be dried either by sun drying or by mechanical drying. Sun drying is the cheapest and popular method Mechanical drying is rapid and is of various types like Tray drying, Freeze drying, Vacuum drying, Microwave oven drying, Air drying etc.

The cultivation starts with compost preparation followed by spawning, casing, harvesting and processing. Mushroom being fragile and perishable commodity requires processing after harvesting. The processing can be accomplished in various ways such as drying, dehydration, freeze drying, pickling, freezing, canning, sterilization, direct packaging etc.

GROWTH IN MUSHROOM PRODUCTION

Though mushroom production in Asian countries started 1000 years ago, cultivation of mushrooms is relatively new phenomenon in India. Even as the mushroom production and consumption are on the rise in rest of the world, India witnesses a lukewarm response in its growth. Commercial production of edible mushrooms represents unique exploitation of the microbial technology for the bio conversion of the agricultural, industrial, forestry and household waste into nutritious food (mushrooms). Our country can emerge as a major player in mushroom production in wake of availability of plenty of agricultural residues and labour. Integrating mushroom cultivation in the existing farming systems will not only supplement the income of the farmers but also will promote proper recycling of agro-residues thereby improving soil health and promoting organic agriculture.

In India, mushroom research started in 60s and the cultivation picked up in 70s. India has varied agro-climate, abundance of agricultural residues and plenty of manpower making it suitable for cultivating different mushrooms. Major part of agricultural waste produce to India is let out to decompose naturally or burnt in situ. This can effectively be utilized to produce highly nutritive food such as mushrooms and spent mushroom substrate can be converted into organic manure. Mushroom growing is a highly labour oriented venture and labour availability is no constraint in the country and two factors, that is, availabilities of raw materials and labour make mushroom growing economically profitable in India. Moreover, scope for intense diversification by cultivation of other edible mushrooms like oyster, shiitake, milky and other medicinal mushrooms are additional opportunities for Indian growers. Mushroom industry in India is overwhelmingly focused on white button mushroom which is a highly sophisticated and capital-intensive activity. The recent production data (official data of ICAR-DMR, Solan) shows that, the share of button mushroom in India is maximum (73%) followed by oyster mushroom which contributes about 16%. There are two main types of mushroom growers in India, those who are growing white button mushroom round the year under controlled conditions and seasonal growers who are growing button mushrooms during the winter seasons.

By effectively utilizing the seasonal variations, the farmers of North India have revolutionized the seasonal cultivation process with very less inputs. Many growers started adopting the seasonal cultivation of white button mushroom as a livelihood and income generating activity in this region. The advantages like nearness to market, availability of raw materials at cheaper price coupled with the availability of good quality of spawn triggering the mushroom production from this region. Initially, white button mushroom production was confined to temperate hilly regions of India. However, with the development of short method of composting and technological advancements, there has been a remarkable change in its production scenario and spread to all the corners of the country.

Mushroom has become an integral part of Indian food and it is cultivated throughout the country. Production of mushroom has increased from 0.04 MT (1997) to 0.18 MT (2019). From 2006-2016, the per capita consumption of mushroom has increased from 42 gms to 80 gms. The five major mushroom species cultivated in India widely are white button, oyster, paddy straw, milky mushroom and shiitake mushroom. Amongst all, white button mushroom is the dominant specie in mushroom production, followed by oyster mushroom, paddy straw mushroom and milky mushroom.

STATE WISE ESTIMATED MUSHROOM PRODUCTION IN INDIA (2021-22)

State	Production (000 tons)
Bihar	28.00
Maharashtra	25.60
Odisha	25.00
Haryana	21.20
Uttar Pradesh	19.80
Punjab	19.15
Rajasthan	18.40
Himachal Pradesh	14.80
Gujarat	14.50
Tamil Nadu	12.66

Source: Annual Report, 2021, DMR, Solan

CHALLENGES IN MUSHROOM CULTIVATION

India has a wide scope for growing different types of vegetables and mushrooms since the climate is appropriately suitable for mushroom cultivation in India. The demand for mushroom is growing since all the country's people are turning in to health-conscious and interested to have the richest source of protein. Challenges involved for mushroom cultivators include, spread of cultivation in the potential area, packaging problems, infrastructural problems etc. The marketing of fresh mushrooms is very challenging in India due to its nature as perishable products. The yield of mushroom to a great extent depends upon quality of spawn. The non availability of good quality spawn is a common problem of mushroom farming. In village areas the workers need to hire vehicles in order to transport inputs such as paddy straw and seeds from areas where they are available to local areas. So transportation charges also increase the input price of mushroom cultivation and affects profits of mushroom farmers. When large quantity of mushrooms is harvested per day, then its marketing becomes a major problem. Since mushroom is an easily perishable commodity, producers in village areas have no access to local markets where they can easily dispose off their produce. Lack of marketing facilities is a cause for the lack of interest among farmers in taking up mushroom cultivation. Most of the problems in mushroom growing arise due to improper hygiene. Hygiene covers all the measures, which are necessary to minimize the possible incidence of the pests and pathogens. Thus, hygiene and sanitation go hand in hand at all stages of mushroom growing. Farm hygiene is the main problem for a mushroom grower since it directly affects the harvest. The people are not aware of the medicinal qualities as well as mineral and protein content of mushroom. So this becomes another problem which affects the marketing of the product.

CONCLUSION AND SUGGESTIONS

The edible mushrooms have unique aroma & flavors and are very delicious as they contain abundant amounts of proteins, vitamins, fiber, and medicinal value. Thus, for vegetarian Indian population it is considered to be the most prominent vegetable. Growing evidence shows that mushroom growth has great potential in many other countries, particularly in developing countries. Mushrooms could be an important sector for our future agriculture and forestry. Mushroom cultivation is an effective bioconversion technology of transforming wastes and woods into potentially valuable resources. Mushroom cultivation could also be an important part of sustainable agriculture and forestry. Given the many mushroom species that have not yet been studied, new discoveries of the health benefits of mushrooms will continue and promising mushroom treatments and products for human diseases may be found in the future.

Mushroom entrepreneurship largely an urban or semi-urban affair, if promoted in the rural areas will achieve multiple benefits like utilizing surplus agriculture residue for producing protein rich food, livelihood security and economic

development among rural people, employment generation and addressing malnutrition by increased mushroom consumption in rural areas. Although, it is necessary that, training programmes on mushroom cultivation should address the technological needs of growers with higher emphasis on hands on training component. It is significant to ensure that the extension events are organized in line with the needs of the stake holders and not just for funds utilization or mandatory organization of events etc.

The marketing of fresh mushrooms would determine the future of mushroom industry in India. Despite the changing currents, there is not yet much market for the processed foods and basically fresh vegetables and fruits are preferred in this country. Fresh mushrooms have very short shelf -life, cannot be transported to long distances without refrigerated transport facility and are sold in localized markets in and around production areas. As India itself is a big market, vigorous extension activities are required to make the people aware of mushrooms, which can help in developing market in India itself. In the coming years there is going to be good demand for processed and fast foods. Mushrooms may be canned to meet the demand in the off season and in the nonproducing areas.

To improve and promote cultivation of mushrooms, various measures can be adopted, such as better hygienic measures to avoid the damage to the harvest, training programmes could be conducted to help the members to develop the skills required for mushroom farming. More and more mushroom producing units can be started as it doesn't require soil other than bio-wastes. Storage and cooling facilities must be provided for the units to procure spawn. The compost left after cultivation should be used for making manure, vermi compost etc. The authorities may promote mushroom cultivation at household level. The workers should be given the facilities for producing spawn, so that they can avoid the problem of collecting spawn from distant areas. The growers must form co-operative societies in order to share the technical information on day to day growing and spawn production. Good and committed entrepreneurs should be encouraged to become involved in the mushroom cultivation. The government must take the initiative for the export of processed mushroom by purchasing from the small scale mushroom farmers.

Mushroom cultivation has become one of the most important agro-based industries and has potential for increasing opportunities, steady employment and income which is still in a nascent stage. Promoting mushroom production will help in enhancing the nutritional and livelihood security in both rural and urban areas.

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